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DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

ADDRESS REPLY TO
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WASHINGTON April 23, 1918.

Confidential Bulletin #7.

1 Photometry of Self-Luminous Materials. Three special photometric outfits designed and prepared by the Bureau for comparing the very feeble illuminations of airplane instrument dials have just been completed and tested, and two have already been shipped to airplane manufactories for the use of inspectors of the Signal Corps in testing of these dials.

2 Circular on Radio Instruments and Measurements. Circular 74, announced in the last issue of the Confidential Bulletin, is finding wide use in the military and naval wireless service. This publication will serve as a collateral text book in the several radio schools being conducted at a number of universities under the auspices of the Signal Corps. The treatment comprises (1) A general introduction to the fundamental electro-magnetic theory of which radio engineering is based; (2) an introduction to the theory of electric oscillations; (3) instruments and methods of radio measurement, including sources of high-frequency currents; (4) formulas and data for the calculation of capacity, inductance and high-frequency resistance, and for the design of inductance coils; (5) a selected bibliography.

3 Leather. Nearly 100 samples of harness, strap and belting leather were tested for the determination of such physical properties as tensile strength, ultimate elongation, resistance to tearing out of buckle, water absorption, etc. In cooperation with the Ordnance Department, several sides of strap and harness leather are being marked off and cut into samples in order that a determination may be reached of the comparative value of different parts of the hide as regards such characteristics as tensile strength, pulling out of buckle, and tearing resistance.

4 Mica for Electrical Instruments. The question of supplying mica suitable for use in electrical instruments, such as magneto condensers for truck engines, has assumed considerable importance. A thorough study has been made of the requirements of mica for this use and the methods available for testing it. Means have been developed for determining the relative utility of mica from different sources and on the basis of such tests recommendations to the War Industries Board regarding the choice of sources of this material will be made.

5 Searchlight Testing. The illumination in searchlight beams over distances from 1/2 to 4 miles has been determined by photometric measurements at the Bureau. Studies have been made of the light distribution as affected by the louvres used to shut off the beam at will and of the front glass which protects the mechanism of the searchlight from the weather.

6 Metallographic Examination of Shrapnel Steel. A rather extended examination of various grades of steel entering into the manufacture of shrapnel cases has just been completed. The material examined included the three 3" slugs from which shells are produced as well as a series of the shells after being formed. The specimens were furnished by the ordnance inspection service, the work being carried out in cooperation with that branch. The results are of value in illustrating, particularly to inspectors, some of the defects which may occur in such material and also show the typical appearance of fractures produced by the nick-and-break test such as is required at present for detecting such defects. In addition, a series of specimens which have been merely sheared apart in order to demonstrate the same defects was examined and compared with the fractures produced in the same material by the approved nick-and-break fracture.

The examination of sections of the finished shells makes clear the nature of the flow of the material during the fabrication process and shows that if any appreciable segregation occurs in the "slug" from which the shell is to be made, this segregation will be very much accentuated in the head of the finished shell, as the central metal does not enter into the side walls but is merely compressed and flows laterally, somewhat, to form the "head".

7 Aluminum Solders. The experiments on aluminum solders have shown that there are several satisfactory solders on the market at the present time. However, all metals used in such solders are electronegative to aluminum, and, therefore, no matter what solder is used the soldered joint is rapidly attacked by water and moisture, becoming completely disintegrated in a short time. Soldered aluminum joints should always be protected against this disintegration by varnishing or painting, except in cases of very heavy joints where slight corrosion would not be serious. The secret of successful soldering of aluminum is the very careful cleaning of the surface to be soldered, tinning the surface with the solder chosen, preferably without a flux, and then proceeding as in ordinary soldering.

8 Effect of Mercury on Metal of "Primer Cup" Composition. The attention of the Bureau has been called by the Ordnance Department to the possible action of mercury and mercury salts on copper and high copper brasses known in the trade as gilding metal, the latter being used for primer cups. The problem arose due to the danger that both free mercury and mercuric chloride may be found in fulminate of mercury, one of the constituents of primer compositions, and the two may cause deterioration of the primer cup, weakening the metal to such extent as to cause the piercing or blowing out of the primer cup when the primer is struck and explodes.

Preliminary experiments on copper and 60-40 brasses have shown that dry mercuric chloride and also metallic mercury corrode the metals so severely as to make them wortnless.

9 Acid-Resisting Alloys. The Bureau has had many inquiries on the subject of acid-resisting alloys to replace the costly and rare platinum. For certain limited purposes there are at present alloys resistant to acids that take the place of platinum very satisfactorily. Among the better known alloys are:

The silicon irons which are used so extensively in the manufacture of chemical works apparatus.

Monel metal, an alloy of nickel and copper, used extensively in ship parts exposed to the action of sea water, in construction of mining machinery exposed to the action of mine waters, and for many other purposes.

Among other alloys worthy of mention as acid resistant for limited purposes are: Stellite, Illium, phosphor bronze and nickel-copper-tungsten alloys.

10 Conservation of Tin in Bearing Metals. Information is being gathered from representative manufacturers and consumers of large quantities of babbit metal and bearing bronzes, on the composition of these alloys with particular reference to the tin content and the possibility of reducing the amount of tin used. Some manufacturers are already effecting a saving of tin while others are still using the pre-war standards. It appears from the data now on hand that a considerable saving of tin can be made without in any way impairing the life or service of the bearing.

11 Embrittling Effect of Metal Coating Processes. It was desired to obtain some idea of the extent to which steel wires are made brittle by pickling and subsequent coatings. As a preliminary indication, the elongation in tensile test was used as a measure of the brittleness. It appears that longer immersion and stronger acid increase the brittleness, while the temperature of the pickling bath is of less importance. Subjecting the rods to the heating conditions of sherardizing completely removed the brittleness, while the zinc hot-dipping heat treatment partially removed it. Zinc electro-plating seemed to have no effect, but plating in a copper cyanide bath greatly increased the brittleness. The differences observed were greater in the case of the normalized rods than in quenched and tempered ones, and in medium-carbon steel than in high-carbon or low-carbon steel.

12 Various Metallurgical Studies. The investigations of the Metallurgical laboratory include a study of alloys suitable for mirrors in airplane cameras; of defective crankshafts of airplane motors; of platinum gauze having certain defects; of season-cracked cartridge cases; microscopic studies of gun steel and malleable iron; of cold punched nuts before and after heat treatment; of steel for oxygen containers; and of cast aluminum tension bars. Study is also being given to the matter of substitution of other materials for the bronze used for the buttons of uniforms.

13 Development of New Types of Airplane Construction. Dies forethe production of wing beams and ribs in both steel and aluminum are now ready. On account of the results of tests in which cold rolled steel was used, the properties of chrome vanadium steel for this purpose are being investigated, including a study of the necessary heat treatment either before or after fabrication. Dead load and flight tests will be made shortly upon this new type of construction. Work on laminated wood beams has been continued and results corroborate the earlier evidences of superiority of these over solid ones, both in point of strength and economy of wood. Wing beams having diagonal grain were also tested, in cross-bending, and showed very satisfactory properties in comparison with earlier samples of straight-grained material. The spliced spruce wing beam was given a cross-bend test after weathering during March in which it was exposed to wind, rain, snow, freezing and thawing. This splice proved to be thoroughly weatherproof.

A study of the properties of artificially dried spruce produced by the application of a new process showed interesting results and the material compares favorably with the woods now used in airplane construction.

Expansion tests are being made on several kinds of mahogany having a varying moisture content, to the end of determining the effect of humidity changes in producing deterioration or warping of propellers.

14 Rotating Bands. A study of the ductility of shell rotating bands, including the effect of cold work, is being carried on; indications are that this investigation will lead to a determination of an important cause of failure of shell bands in service.

15 Technical Test of Shrapnel Components. Special apparatus was designed for testing the diaphragm used in anti-aircraft shrapnel. Results of the test showed clearly that the deflections mentioned in the specifications were in error, and this work will form a basis for the establishment of a proper specification covering the strength and rigidity of this component.

16 Materials for Uniforms. Comparisons were made between the air permeability and heat conductivity of the English service blouse and overcoat and the proposed American blouse and overcoat. The latter are made of a lighter weight of woolen cloth than are the English garments, but have cotton linings, giving a somewhat greater overall weight. The results of the test indicate that the garments of the lighter weight woolen fabric with cotton lining are warmer than those of the English wool construction.

17 Balloon Fabric Investigations. Special studies have been made of the durability of balloon fabrics and as a direct result data of the most important character have been developed. In one case, it was found that fabrics entering into the construction of a number of valuable balloons were very poor from the standpoint of their lasting qualities. The experimental work done and the data

reported had the effect of stimulating the research activities of the manufacturers to such an extent that an extraordinary improvement in quality was obtained within a few months. These investigations have included a study of the effects of solar radiation on balloon fabrics, both as regards the deterioration of the fabric and the stability of the balloon buoyancy. Other technical questions arising in connection with balloon work include the matter of proper composition of the rubber used for coating fabrics, the effect of heat upon the life and permeability of the rubber films, the effect of balloon gas and gaseous impurities on the fabric and the rubber. Special methods for determining the permeability of balloon fabrics to hydrogen and other gases were developed. The routine testing has included over 1,000 permeability determinations and 170 exposure tests on 429 different samples. A comprehensive report covering the results of the more important investigations outlined above will appear in the Third Annual Report of the National Advisory Committee for Aeronautics.

18 Photo-electric Effects. Studies have been made of the spectral photo-electric sensitivity of molybdenite and of selenium resulting in information having considerable scientific value and applicable also to certain military problems. The work of this section has included the determination of spectral transmission of several types of glass used in military work; a number of conferences and correspondence regarding military uses of certain radiations; also specifications for protective glasses and data on the emission characteristics of quartz mercury vapor lamps.

19 Munitions Gage Testing. The work of testing munition master limit gages for various departments of the federal government, including the Ordnance Department, Quartermaster's Department and Signal Corps of the United States Army, and the Navy Department, includes at the present time the test of gages at the rate of five thousand a month. All tests are handled promptly and special care is exercised in order that gages tested and results of the test shall reach the interested parties without delay. The establishment of a branch Gage Testing Laboratory in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, was arranged to provide proper facilities for the many gage makers and munition manufacturers located in the New York district. Service will be available in the New York laboratory which will enable interested parties to submit gages and have them returned the same day or the day following. Particular care has been taken to secure a location which will be convenient for parties travelling into and out of New York City. Special apparatus has been designed and constructed for use in connection with testing of thread gages and profile gages of complex form. In this connection, drawings and information have been furnished to enable manufacturers to duplicate the machines in use at the Bureau.

3582 Munitions gages were tested during the month of March

exclusive of those handled by the field force. More than 1,000 of these were submitted during the last week of the month and were handled without delay or congestion. In connection with one type of gun alone over 155 master gages were measured.

20 Altitude Laboratory. A series of determinations of the effect of fuel composition upon engine power have recently been made in the altitude laboratory, and a program of considerable importance to determine the effect of varying composition and types of fuels is being continued. The results of this work have already led to the conclusions that decided advantages may be secured by the selection of special airplane fuels.

Carburetors specially adjusted and equipped in the altitude test chamber have been given trial in flights at Dayton and show a fully satisfactory agreement between the results obtained under the artificial altitude conditions of the test chamber and the conditions in actual flight.

21 The Spark Plug Investigation. The progress of the spark plug work is proving very satisfactory. In cooperation with the Signal Corps, arrangements have been made for the purchase of 1500 each of the most promising makes of American spark plugs, partly on the basis of the laboratory tests of the Bureau and partly in accordance with the experience of flying fields which are cooperating with the Bureau. The major part of these plugs will be used in engines abroad. Reports from Europe indicate that the spark plugs produced in this country are equal, if not superior to those abroad.

22 Other Engine Accessories. A special pressure indicator is being designed for detecting preignition and plotting curves of the pressure obtaining in gasoline engine cylinders. Active steps are being taken in the development of a cooperative arrangement between the Bureau and a number of carburetor manufacturers to the end of designing aeronautic carburetors along the line indicated by the researches in the altitude laboratory. This phase is most important in view of the fact that the requirements in the operation of aeronautic carburetors are distinctly different from those of carburetors for use at ground level, hence a very radical revision of the conventional methods of carburetor design is to be looked for.

Respectfully,

S. W. STRATTON

Director.